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Relative Susceptibilities of Three Ponderosa Pine Sources to European Pine Sawfly (Hymenoptera: Diprionidae) Attack in Michigan

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RELATIVE SUSCEPTIBILITIES OF THREE PONDEROSA PINE SOURCES TO EUROPEAN PINE SAWFLY (HYMENOPTERA: DIPRIONIDAE) ATTACK IN MICHIGAN

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INTRODUCTION

Accidentally introduced into New Jersey about 1925, the European pine sawfly, *Neodiprion sertifer* (Geoffroy), now inhabits most of the Northeastern and North Central States and Ontario, Canada. Red pine, *Pinus resinosa* Aiton, and most other native and exotic pines within its range are susceptible to attack. Few attack records are available for ponderosa pine, *P. ponderosa* Douglas ex Lawson, because this pine is uncommon in eastern North America. Soraci (1939) observed egg clusters and larval feeding on planted red and ponderosa pine in New Jersey; Benjamin *et al.* (1955) found egg clusters on ponderosa pine in Illinois and recorded more intensive attacks on redpines nearby. However, quantitative data on the relative susceptibility of ponderosa pine to sawfly attack have never been reported.

Because it is highly probable that *N. sertifer* will someday establish itself farther west, where ponderosa pine is abundant, information about ponderosa pine susceptibility to sawfly attack is of interest. In light of this need the following research was undertaken. It compares attacks on three ponderosa and one red pine seed source.

MATERIALS AND METHODS

Ponderosa pine seedlings from three sources in Oregon (*viz.*, Deschutes, Rogue River, and Wallowa-Whitman National Forests), were outplanted in the spring of 1960. They are examples of the Pacific Coast variety, *P. ponderosa* var. *ponderosa*, which differs somewhat from the more easterly and southerly varieties (varieties *scopulorum* and *arizonica*) not represented in the study. See Wells (1964).

Seedlings from all three sources and red pine seedlings from Michigan were planted together in clearings surrounded by large red and Scotch (*P. sylvestris* L.) pines in three Michigan counties (Ottawa, Oceana, and Clinton). Two experimental blocks of 80 seedlings each were established at each locality. Each block had five 4-tree plots representing the several seed sources set out in a completely randomized design. Unfortunately, the Rogue River plots had to be replanted in 1961 because of heavy mortality the first year.

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All trees in each infested block were checked annually from 1962 to 1965, during which the egg clusters were counted. Only the two Clinton County blocks were found attacked by the sawfly.

VARIATION IN SAWFLY ATTACK

Red pine was attacked more heavily than was ponderosa in all 4 years. Attacks increased 400 percent in 1965, and differences in attack that year became apparent among the ponderosa pine seed sources (Table 1). The 1965 data and the combined 4-year data revealed large differences (significant at the .01 level) between red pine and the three ponderosa pines. *P. ponderosa* 'Deschutes' had fewer attacks than either *P. ponderosa* 'Rogue River' or *P. ponderosa* 'Wallowa-Whitman' (Table 1).

Lyons (1964) and Wright *et al.* (1966) have shown that European pine sawfly attacks are often directly related to tree height, so further tests were made after height adjustment, because the replanted Rogue River pines were much shorter than the others (Table 1). The results of the analyses, however, remained the same. Interestingly, the *P. ponderosa* 'Deschutes' trees were among the tallest trees but still the least susceptible to attack.

TABLE 1. Number of European pine sawfly egg clusters on all plots and mean tree height for ponderosa and red pine seed sources, Clinton County blocks.

Cultivar name of species of *Pinus*	Egg clusters					Mean tree height
	1962	1963	1964	1965[a]	all years[a]	1965
	------NUMBER------					INCHES
P. ponderosa 'Deschutes'	0	0	1	4	5	55
P. ponderosa 'Rogue River'	0	0	3	16	19	35
P. ponderosa 'Wallowa-Whitman'	2	0	3	16	21	58
P. resinosa 'Michigan'	9	14	12	41	76	48
TOTAL	11	14	19	77	121	--

[a]The analysis of variance showed highly significant differences between red and all ponderosa pines.

DISCUSSION AND CONCLUSIONS

The mechanisms underlying the obtained variation in sawfly attack were not fully determined in the study. Host conditioning may have been partly responsible for the red pine preference; most of the sawflies that attacked the test trees developed on red pines surrounding the experimental blocks. However, at one location some very likely had developed on nearby Scotch pines, too.

Randall (1965) found that sawfly-resistant Scotch pine varieties have wider needles than do susceptible ones. Ghent (1959) reported that *N. sertifer* will not oviposit on needles wider than 2 mm. Needles of ponderosa or red pine are narrower than those of Scotch pine, so this could not account for differences in susceptibility observed here.

It is possible a minimum needle width could also be responsible, but this was not checked.

The location of the plots was examined in order to explain the apparent low susceptibility of *P. ponderosa* 'Deschutes'. In the intensively attacked block, border plots of all trees combined had more egg clusters than did inner plots. Only two of five *P. ponderosa* 'Deschutes' plots were on the border, whereas the other sources each had four border plots. However, when only border plots are considered, *P. ponderosa* 'Deschutes' trees still had less than one-fourth as many egg clusters as either of the other two ponderosa sources.

Considerable speculation exists about the role that pine resins play in the attraction of sawflies. The quantity and quality of compounds in pine oleoresin vary considerably among pines and among sources in ponderosa pine (Mirov, 1961). Smith (1963) tested several ponderosa sources and reported great variability in resin volatilities at room temperature. Definitive studies are needed to test the importance of differential volatility of resin in causing host resistance.

Whatever mechanisms are involved, Michigan red pine was preferred for oviposition over the three Oregon sources of ponderosa pine. In addition, *P. ponderosa* 'Deschutes' was very lightly attacked, indicating possible inherent resistance compared to the two other ponderosa seed sources.

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